Opening-Up & Spreading-Out the Brain: Examining Neurobiological Principles Through Online-Database Research in Neuroscience Teaching

A Fellowship Proposal

By
Dr. Sally Bernardina Seraphin
Neuroscience Program

On
May 15, 2020

For
Center for Teaching and Learning
Trinity College
Hartford, Connecticut

I. BACKGROUND

Each learner must be supported in becoming a skilled, skeptical and compassionate human citizen of our planet. This can only be achieved by meeting learners where they are, both literally and figuratively. In the literal sense, this means delivering knowledge to their doorstep, with convenience that makes it inescapable. In the figurative sense, that means teaching information in multiple ways to maximize its accessibility and broad applicability. For these reasons, I have adopted a pedagogical approach that is best described as "multimedia enhanced peer-teaching and experiential learning".

Thus far, my approach has been rooted in the use of Non-Disposable Assignments (NDAs). In contrast to traditional assignments (i.e., exams), which are graded and discarded, NDAs check student mastery of course principles while affording them a more active role in the creation and dissemination of knowledge. Through NDAs, students generate presentations, web content, white papers or information resources that can be shared with fellow students or even with communities outside of traditional academic institutional boundaries. In a recent peer-reviewed article entitled "A Conceptual Framework for Non-Disposable Assignments: Inspiring Implementation, Innovation, and Research" that was published in the Journal of Psychology Learning and Teaching's upcoming Special Issue on Open Educational Practices, I argued that the use of NDAs can help students build the soft skills and digital media literacy demanded by the twenty-first century workforce (Seraphin, Et. Al., 2019). I showed that course learning objectives are not only facilitated, but that learning is potentially deepened, when students recognize the societal benefit and public or business applications of their work.

As a behavioral sciences teacher-scholar, I have found the use of NDAs to be especially appropriate to teaching psychology, where it further empowers diverse students to challenge and reinterpret the canon of ideas passed down from white forefathers of the discipline. I have, however, struggled with ways to teach neuroscience that encourages students to progress beyond being pure recipients of knowledge and to help generate or revise perspectives on the workings of the brain. Meanwhile, recent developments in cultural neuroscience, neurolaw, and the understanding of biological versus environmental differences in form and function of the brain require that even undergraduates are empowered to shape the narrative around the workings of the mind. This project will help me impart Trinity students with skills for investigating neurological phenomena.

II. PROPOSED TEACHING PROJECT

In a project entitled "Opening-Up & Spreading Out the Brain: Examining Neurobiological Principles Through Online-Database Research in Neuroscience Teaching", **I propose to develop ways to employ "big data" from vast online stores of neuroimaging, psychological, and health research in active teaching/learning for a new lecture and lab course: NESC-313-01: Emotion and Motivation and NESC-313-20: Emotion and Motivation Lab that will be taught at Trinity College in Spring-2021**.

The project will have three phases: Database Selection, Lab-Activity Development, Assessments Creation. First, in the Database Selection phase, candidate databases will be evaluated on the quality of neuroscience data, the ease of remote access and manipulation by students, and any financial cost or restrictions around data use. Some of the databases that are currently under consideration include:

A. Longitudinal Studies
   - The Wisconsin Longitudinal Study (WLS)
   - The Sacramento Area Latino Study on Aging (SALSA Study)
   - CORGIS: The Collection of Really Great, Interesting, Situated Datasets
   - The University of California Irvine Machine Learning Repository

B. Brain Imaging Datasets & Visualization Tools:
   - Open Access Series of Imaging Studies (OASIS) Brains
   - Brain Imaging Data Structure (BIDS)
   - The Human Connectome Project
   - OpenNeuro

- OpenfMRI
- The Stanley Medical Research Institute online genomics database (SMRIDB)

C. Behavioral Datasets

- RAND Social and Economic Well-Being Surveys
- University of Michigan Institute for Social Research (ISR)
- Harvard-MIT Institute for Quantitative Social Science (IQSS)

Second, in the Lab-Activity Development phase, active learning opportunities will be designed around neurobiological questions/problems that both map onto course learning objectives and can be addressed by manipulation of the selected databases and visualization tools. For example, older people often report negative moods, which are themselves associated with the brain limbic system. Students could be assigned the question: *"How is life-history stage linked to mood?"* to be answered using a subset of data on mood ratings and hippocampal-amygdala size/function according to age. As demonstrated by Safadel & White (2019) teaching with data allows students to visualize neurological phenomena through their own intimate handling of variables and drawing of conclusions. Besides exercising student's metacognition, this will lead to increased literacy and confidence with scientific methods. Finally, in the Assessments Creation phase, assignments will be generated in connection with learning objectives and detailed grading rubrics that are mastery based (for definition of mastery-based grading, see: Armacost & Pet-Armacost, 2003; and Heubach, S., & Krinsky, S., 2019).

III. PROJECT RATIONALE

Brain sciences courses typically require extensive laboratory resources and face-to-face teaching. By developing methods for teaching a new Trinity course (Emotion and Motivation Lec/Lab) using public data, I can both greatly expand the physical classroom boundaries (spreading-out the brain) and ensure course portability to online-teaching, in the event of future COVID-19 related campus shut-down. Besides increasing student's access to laboratory neuroscience in the confines of an online course, teaching with data (opening-up the brain) will help Trinity students develop important skills in understanding scientific systems, methods, and processes that are currently in high demand for data scientists.

IV. EXPECTED PROJECT IMPACT

In addition to helping me to prepare a new Trinity course offering, my year-long endeavor to develop methods for teaching with big data will influence my pedagogical approach as an instructor for the following Trinity courses: (1) NESC-301-01: Intro Neursci Method-Lab, (2) NESC-305-01: Neurolaw, (3) PSYC-261-02: Brain and Behavior. It will also radically shift my approach to teaching "laboratory science," with the result that my students will grow equipped and inspired in their future critical thinking about neuroscience phenomena.

V. LITERATURE CITED

Armacost, R. L., & Pet-Armacost, J. (2003, November). Using mastery-based grading to facilitate learning. In *33rd Annual Frontiers in Education, 2003. FIE 2003.* (Vol. 1, pp. T3A-20). IEEE.

Heubach, S., & Krinsky, S. (2019). Implementing Mastery-Based Grading at Scale in Introductory Statistics. *PRIMUS*, (just-accepted), 1-25.

Safadel, P., White, D. Facilitating Molecular Biology Teaching by Using Augmented Reality (AR) and Protein Data Bank (PDB). TechTrends 63, 188–193 (2019). https://doi.org/10.1007/s11528-018-0343-0

Seraphin, S. B., Grizzell, J. A., Kerr-German, A., Perkins, M. A., Grzanka, P. R., & Hardin, E. E. (2019). A Conceptual Framework for Non-Disposable Assignments: Inspiring Implementation, Innovation, and Research. Psychology Learning & Teaching, 18(1), 84–97. https://doi.org/10.1177/1475725718811711